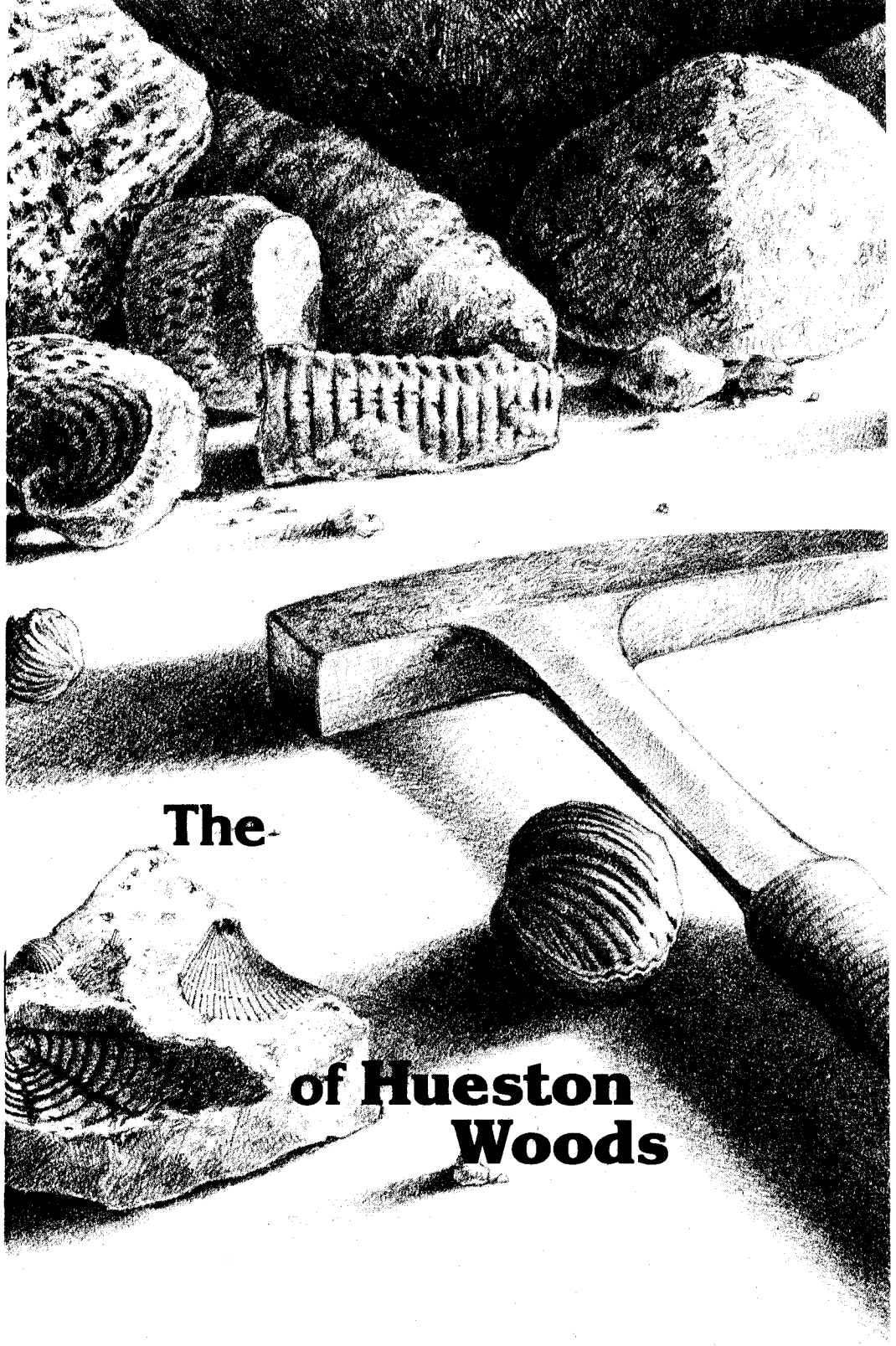
The
of Hueston
Woods

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NOTE:

All fossils are natural size unless otherwise stated.

2 Ohio Geology

The story of Ohio's distant past has been recorded in her rocks. It is written in layers of mud and sand which consolidated into shale, limestone, and sandstone and in the fossils they contain. These records permit us to decipher the events that preceded the coming of man in Ohio and to trace the history of the land from the very beginning of the earth to the present.

The geologist cannot record events year by year, as the historian does, except in very special circumstances. Still, various kinds of evidence can be used to divide geologic time into broad segments and fit events into a coordinated timetable which applies to the entire earth. This geologic timetable (see Fig. 1) shows these divisions of time as eras and periods, which approximate duration and the type of life present during each period. Study of this chart will help you see what periods are represented in Ohio and how they fit into geologic time.

If we examine Ohio's rocks in detail, we find that many of them bear abundant fossils, which are not merely strangely-shaped rocks, but the traces and remains of plants and animals that once lived and died where we find them. We can recognize among the fossils of Ohio abundant remains of corals, sea shells, ferns, and tree trunks. It is soon obvious that some rocks contain only corals and sea shells while others contain only plant remains. The fossil collector will soon learn that to find coral fossils he must travel to the western half of the state, whereas plant fossils are found in the bedrock of the eastern half of the state.

Corals live only in the sea and are not found in lakes and rivers. Ferns and trees obviously live on land or in swampy places. With these facts in mind, it is nothing short of staggering to realize what this means — the whole state was covered not only once, but several times, by the sea. Ohio was only a part of a great inland sea that extended at times from the Gulf of Mexico to the Arctic. In later times, the sea withdrew from Ohio leaving a vast swamp covered with abundant vegetation. Some of this vegetation, when buried by debris, mud, and sand, formed the coal beds which we find between layers of rocks bearing fern leaves and tree trunks.

Fossil collectors should have some idea of how rocks are classified and the significance of this classification with regard to fossils. Rocks are subdivided, according to their nature and relative age, into systems, series, groups, formations, members, and beds. A general classification of rocks is given in fig. 1. Examination of this table will show that only Paleozoic and Cenozoic sediment are found in Ohio, and that the Cenozoic is represented only by Quaternary rocks, the very youngest of the Cenozoic rocks. The geologic map of Ohio (Fig. 2) shows the distribution of rocks by systems in Ohio.

Geologic Time Chart

ERA	PERIOD	APPROX DURATION	LIFE
CENOZOIC	QUATERNARY	2 Million	Rise and dominance of man and other modern organisms.
	TERTIARY (Not found in Ohio)	59 Million	Mammals important. Modern plants and animals appear in abundance.
MESOZOIC	CRETACEOUS (Not found in Ohio)	60 Million	Mollusks abundant. Dinosaurs
	JURASSIC (Not found in Ohio)	45 Million	Reptiles important.
	TRIASSIC (Not found in Ohio)	50 Million	Conifers appear. Reptiles abundant. First mammals.
PALEOZOIC	PERMIAN	40 Million	Extinction of trilobites. Rise of land vertebrates.
	PENNSYLVANIAN	50 Million	First reptiles. Primitive plants abundant. Coal-forming fossils.
	MISSISSIPPIAN	30 Million	First amphibians. Profusion of crinoids and blastoids.
	DEVONIAN	60 Million	Fish and spiriferid brachiopods. Decline of trilobites. Numerous corals and sponges.
	SILURIAN	30 Million	Profusion of nautiloids. First land plants. Coral reefs appear.
	ORDOVICIAN	75 Million	Nautiloids and trilobites abundant. First fish. Brachiopods and bryozoans important.
	CAMBRIAN	60-105 Million	First well-preserved life. Almost all phyla present. Trilobites most important.
CRYPTOZOIC			Primitive life

Fig. 1

Geological Map of Ohio

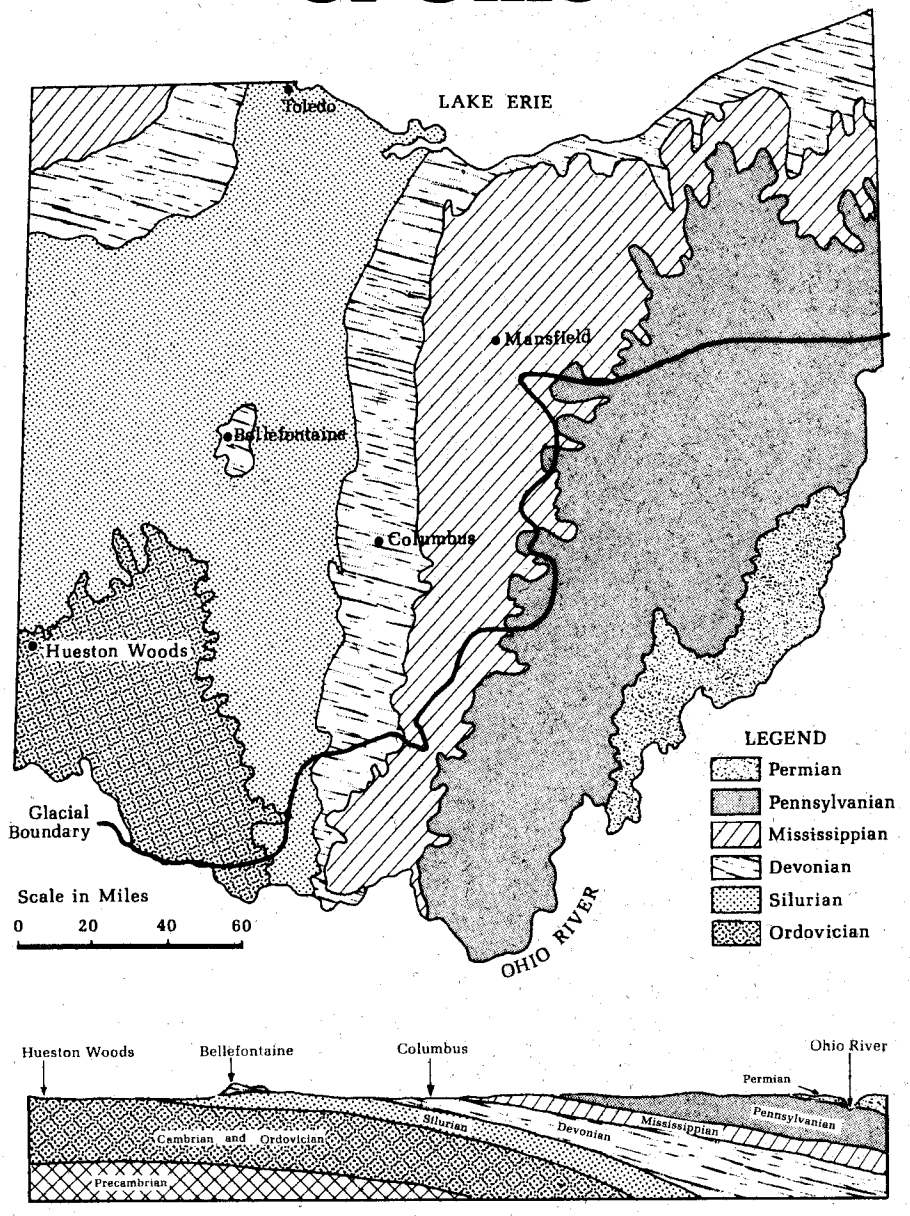


Fig. 2

Geology of Hueston Woods

The beds of rock in Ohio are tilted toward the east, with the oldest rocks being exposed at the surface in the west including the area of Hueston Woods, and the youngest in the east. This tilting is due to the Cincinnati dome, a warping of the strata in the Cincinnati area which occurred in the Early Paleozoic era. In the northern and western parts of the state, Ohio's bedrock is buried by deposits left by the glaciers that departed from Ohio as recently as 14,000 years ago.

The Ordovician period, which is represented by the rocks found at Hueston Woods, derived its name from an early Celtic tribe (Ordovices) that lived in the region of Wales where the Ordovician rocks were first described. This period began approximately 500 million years ago and lasted almost 75 million years. The climate of Ohio during that time may be compared to that of the Bahama Islands at the present time. The majority of Ohio's Ordovician rocks are limestones and shales, which accumulate under very special conditions. Limestones are precipitated from sea water far from shore or near low-lying lands, generally in mild or tropical climates.

The waters of the Ordovician sea teemed with marine life in an abundance that can scarcely be matched in the world today. Some of these creatures would look familiar but others would look strange indeed, for they have long been extinct. This abundance of life during the Ordovician period has made southwestern Ohio one of the best fossil collecting areas in the world.

What Are Fossils?

Fossils are the remains or imprints of prehistoric plants and animals which have been preserved in partial or complete form in sediments. A fossil can be as large as a dinosaur skeleton or as small as plant pollen or fungi spore. Fossils include representatives of most of the major groups of plants and animals.

The process of fossilization takes place over a long period of time and in many different ways. In most cases only the hard parts of organisms are preserved since soft parts usually decay rapidly after death.

As the marine organisms died their remains accumulated on the sea floor. The layer of organisms and sediments built up to such a great depth that their weight hardened the material into rocks such as limestone, sandstone, or shale, depending on the substances present.

Petrification of animal remains usually occurs through a molecule-by-molecule replacement, or a recrystallization, of the hard parts with minerals such as calcite or quartz. The plant remains in southwestern Ohio have undergone a carbonization process to form coal. Fossils include molds and casts of the interior of organisms, and tracks and burrows of worms and other organisms preserved in shales.

In many cases the age of rocks in a particular area may be determined by the types of fossils they contain. Fossils are important to geologists because they tell the story of the earth's history.

Common Types of Fossils Found at Hueston Woods

Since most of the upper Ordovician rocks found at the surface in this part of the state are endowed with an abundance of fossils, it is not surprising that the beginner soon becomes discouraged when it comes to identification. It has been recorded that over 700 species have been described from the Ordovician in the Cincinnati region. Since it would be impossible to include all of these fossils in a compact booklet, we are including only a few of the common fossils found in the Ordovician bedrock.

Bryozoans

A bewildering abundance of bryozoans is found in the Ordovician rocks of Ohio; thus the period is often called the age of the Bryozoan Reefs. Bryozoa ("moss animals") usually form colonies in which the individual is almost microscopic in size. Many bryozoans look like miniature corals and take shapes that are twig-like and fan or sheet-like. Some forms may be recognized by their external characteristics, such as bumps, ridges, spot-like masks and star-shaped patterns.

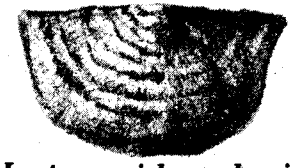
Hallopora subnodosa

Constellaria polystomella

Brachiopods

Lepidocyclus capax

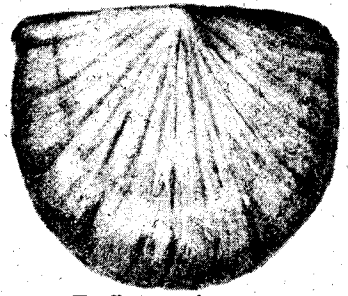
Hebertella occidentalis



Leptaena richmondensis

The brachiopods, or lamp shells, look a little like clams, but they can be easily recognized by looking at the shells. In most brachiopods a line drawn from the pointed beak to the opposite margin of the shell separates the shell into two halves that are just alike, a feature known as bilateral symmetry. In a clam shell the beak is nearer one end. All brachiopods live in the sea and attach themselves to the bottom by means of a fleshy stalk, called a pedicle, which grows out through a hole near the beak of the shell. Brachiopods are not as numerous as in the past, but about 1200 species may be found in the seas today. The fossil brachiopods are represented by many genera and species and literally millions of individuals. Only the more common species are included here.

Strophomena planumbona



Rafinesquina sp.

Onniella meeki

Platystrophia moritura

Horn Corals

The horn corals belong to a group of marine animals which include the corals and the sea anemones. Most of the living corals are colonial, but a large number of the fossil ones were solitary. The solitary forms, such as the extinct horn corals, secreted a cuplike shell which is divided internally by partitions called septa. These corals grew upwards, with the point attached to the seafloor. The shell of the coral is solid enough to be preserved, but the soft parts lack the solid substance and are rarely found preserved. The most common of the horn corals belong to the genus *Grewingkia* and may be recognized by their hornlike shape. Some people still call these fossils cow horns.

Grewingkia rustica

The Mollusks

This group includes the clam, snail, squid, octopus, and related animals. They generally have a soft body, enclosed in a fleshy mantle, and move about by means of a foot. The animals are commonly enclosed in a solid, limy shell. The mollusks are divided into five classes, but only three, Pelecypoda, Gastropoda, and Cephalopoda, are important as fossils.

Modiolopsis modiolaris

Ambonychia radiata

Pelecypods

This class is well known to everyone, for it includes the clam, scallop, oyster, and mussel. The class gets its name (*pelecys,* hatchet; *podos,* foot) from the shape of the muscular foot. Typically, the body is enclosed in a shell of two valves, like the brachiopod's, but in the clam the valves are mirror images of each other and not bilaterally symmetrical. The external appearance and the shape of the pelecypod valves are important in identification.

There are only a few common pelecypods found in the Ordovician rocks, and good specimens of these are unusual. Pelecypods are often preserved as internal molds with closed or open valves. These do not show the external characteristics but may be quite useful for identification.

Pterinea demissa

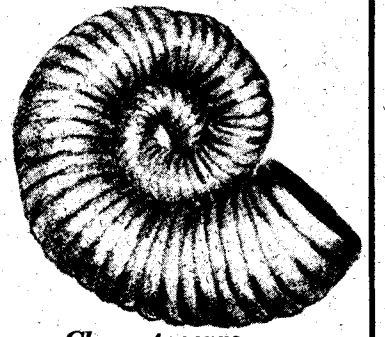
Cephalopods

The squid, devilfish, octopus, and their relatives are not numerous in present day seas. In the ancient seas they were much more numerous and varied. The Cephalopoda (cephale, head; podos,foot) are divided into three subclasses, but only one, the nautiloids, appear in the Ordovician rocks.

Most Ordovician nautiloids had straight, conical shells, but in the Richmond formation some coiled shell forms are occasionally found. In this group the animal lives inside the shell, which is divided into compartments by walls called septa. The septa are pierced by round holes through which a tube-like organ, the siphuncle, passes. The group is exclusively marine and has only one living genus today, the pearly nautilus.

Nautiloids are not readily identifiable from external characteristics. Genera are based on the character of the siphuncle, and where it goes through the septa. For this reason, specimens in which half the shell has been worn away, showing the siphuncle, should be collected.

Orthonybyoceras sp.

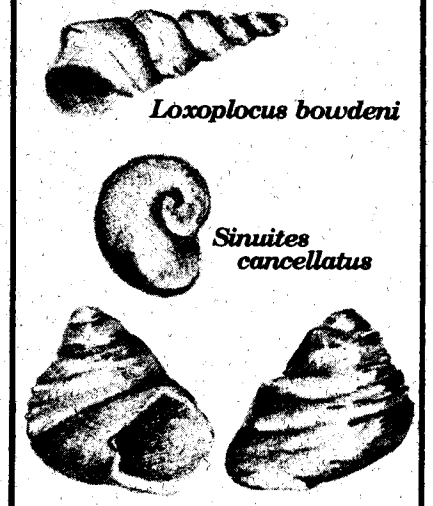


Charactoceras

Gastropods

The snails, which are members of the Gastropoda (gastros, stomach; podos, foot), are a most remarkable group, for they are the only mollusks that have become adapted to terrestrial life. However, most snails are aquatic, and many are exclusively ocean dwellers.

Several kinds of gastropods are found in the Ordovician rocks; however, they are never as abundant as the brachiopods and bryozoans. All of them are small (an inch or less long) and their preservation is often poor, but there are exceptions in which ornamentation of the shell is beautifully sharp and clear.



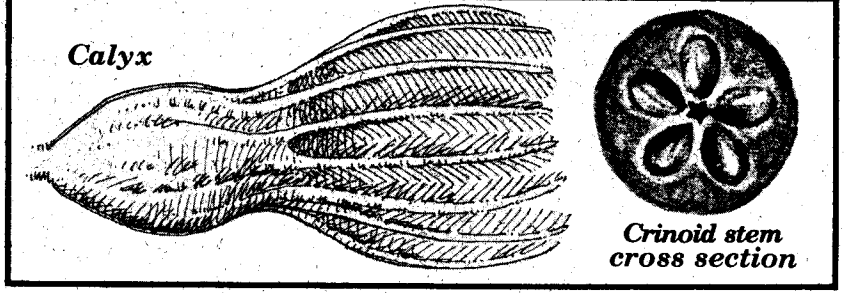
Loxoplocus bowdeni

Sinuites cancellatus

Cyclonema bilix

Crinoids

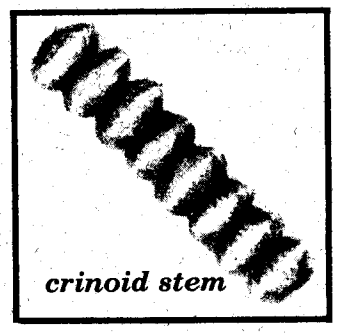
Most crinoids or "sea lilies" have a stem which anchors the animal to the bottom; there are a few free-swimming or, more exactly, floating forms. Crinoids are related to the starfish, sand dollar, and sea cucumber, and have five-fold symmetry, which is characteristic of the group. Crinoids have a globular body or cup to which are attached five arms which may be longer than the cup. After death, the stem is preserved in sections or separated into pieces called columnals. Notice the star-like pattern on the end of the columnal. This will help you distinguish it from a small cephalopod.



Calyx

Crinoid stem cross section

Crinoids are abundant in Ordovician rocks, but perfect specimens are seldom found. On the other hand, there is scarcely a formation in which crinoid stems and joints are not abundant. No Ordovician crinoid is common enough in Ohio to deserve description here, but an example of a crinoid stem is shown.

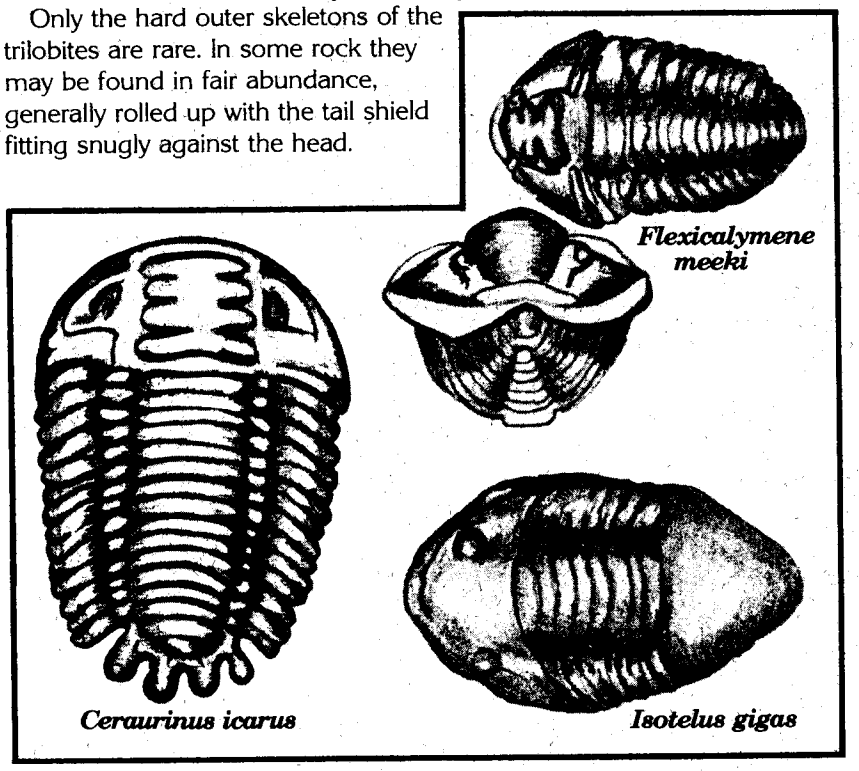


crinoid stem

Trilobites

This is another extinct group, and can be recognized by two grooves that run from head to tail and divide the body into three distinct areas. The three-fold division may be obscure on the head and tail of some trilobites, but it is always clear on the mid-section segments; thus the name, meaning three-lobed. The trilobites were exclusively marine and are related to the modern day insects, spiders, lobsters, and crabs.

Only the hard outer skeletons of the trilobites are rare. In some rock they may be found in fair abundance, generally rolled up with the tail shield fitting snugly against the head.



Flexicalymene meeki

Ceraurinus icarus

Isotelus gigas

Where to Learn About Fossils

Sooner or later, you will want to put a name on each one of your fossils. As a collector of fossils in this area you will soon find that only a small number from the total list of Ordovician fossils are illustrated and discussed in the booklet.

You may want to visit the fossil exhibits at the University of Cincinnati Museum, at the Cincinnati Museum of Natural History, at the Geology Department of Miami University in Oxford, or at the Orton Hall Museum at Ohio State University in Columbus. While in the park, visit the Nature Center, which also has a display of Ordovician fossils, and take part in the naturalist field trips during the summer months. Consult the nature program schedule for details concerning field trips and other year-round programs.

You may also want to consult such books as "Ohio Fossils," Bulletin 54 published by the Ohio Department of Natural Resources, Division of Geological Survey, or "Elementary Guide to the Fossils and Strata of the Ordovician," published by the Cincinnati Museum of Natural History. Both are fine references for the amateur collector.

Finally, don't hesitate to take your puzzling specimens to a specialist, for most paleontologists are pretty good-natured about helping out—you may have found something really worthwhile.

Where to Collect Fossils in Hueston Woods

It is not the usual policy of the Division of Parks and Recreation to permit collecting of any kind within state park boundaries, but since Ordovician fossils are so abundant in Hueston Woods, collecting of fossils is permitted by individuals for personal collections. Commercial collecting is strictly prohibited. Please practice good conservation while collecting. This will insure that the collecting areas remain in their natural condition.

A map of the park on which good collecting areas are indicated with stars is provided on the adjoining page.

It is hoped that this booklet has been enjoyable, as well as informative, and has encouraged you to learn more about Ohio's history as it is written in the rocks.

Portions adapted from "Ohio Fossils," Bulletin 54, by permission of the Division of Geological Survey, Ohio Department of Natural Resources.

Hueston Woods Map